

A REVIEW OF THE SUBFAMILY KORINNINAE (PHASMIDA: PSEUDOPHASMATIDAE), WITH THE DESCRIPTION OF A NEW SPECIES

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The subfamily Korinninae is reviewed. A key to genera and species is provided. *Kalocorinnis pulchella* (de Haan), was previously placed in a different suborder, was found to be the senior synonym of *Kalocorinnis calopteryx* Günther. Variation in the males of *K. pulchella* is discussed and illustrated. A new species, *Kalocorinnis wegneri*, from Borneo, is described and illustrated. The female of *Korinnis errans* Günther is illustrated. The egg of *K. wegneri* is the first egg to be described and illustrated from this subfamily.

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This paper is produced as the result of a visit to Leiden (RMNH) to examine the type specimens of de Haan. During this visit it was discovered that one of de Haan's species appeared to be the same as the paratype of a species described by Günther in 1944 which is also in the RMNH collection. According to the literature however the two species were considered to be in different suborders. Careful cleaning and examination of de Haan's type specimen showed that it had been placed in the wrong suborder by Redtenbacher in 1908.

The RMNH collection has a large number of unidentified specimens, many from Borneo. These were examined and several more specimens of this subfamily were located, including one species which is described here for the first time.

KORINNINAE

Korinninae Günther 1953: 550. – Type genus: *Korinnis* Günther 1932.

The subfamily belongs to the suborder Areolatae and family Pseudophasmatidae. This is a small subfamily which is restricted to south east Asia. The subfamily contains only four species which fall into two genera. The two suborders of Phasmida are distinguished by the presence of a triangular depression on the underside of the apex of the middle and hind tibiae in the Areolatae, and the absence of this feature in the Anareolatae. The use of Bradley & Galil's key to families (1977: 178) places these species in the Pseudophasmatidae because the tarsi have five segments, the first abdominal segment is longer than

metanotum, the metanotum is longer than it is wide, and the antennae are long and filiform. The key to subfamilies of Pseudophasmatidae (Bradley & Galil 1977: 200) refers these species to the Korinninae because they possess normally formed elytra, four unarmoured carinae on the femora, and they lack ocelli.

The following key serves to distinguish the genera and species of the subfamily.

Key to the subfamily

1. Base of fore femora curved, mesonotum with large tubercles, wings not coloured, or only tinted (*Korinnis* spp.) 2
- Base of femora straight, mesonotum smooth, wings strongly coloured (*Kalocorinnis* spp.) 3
2. Mesonotum evenly tapering and not armed with blunt spines *Korinnis errans* Günther
- Mesonotum tapers in two distinct stages and is armed with eight blunt spines *Korinnis potameis* Günther
3. Mesonotum evenly tapering and not armed with blunt spines *Kalocorinnis pulchella* (de Haan)
- Mesonotum tapers in two distinct stages and is armed with six blunt spines *Kalocorinnis wegneri* **sp.n.**

Ragge (1955), in his study of wing venation in Phasmida, did not examine any representative of the Korinninae. The wing venation agrees with the general pattern which Ragge found in all groups that he examined (1955: 390). In the Korinninae the costa, subcosta, radius, cubitus, and first anal are all un-

branched, the media branches near the base to form the anterior and posterior media. Ragge considered an unbranched radius to be unusual, this state occurring only 'in isolated genera (or even species) in two subfamilies (Aschiphasminae and Necrosiinae)'. The only difference within the Korinninae is the length of the subcosta; this is between three quarters and four fifths of the wing length in *Korinnis* but only about two thirds in *Kalocorinnis*. The females of all four members of the subfamily have an operculum with a deep notch in the apex. This condition is rare in Aschiphasmatinae (present in one out of 13 species examined) although not unusual in the Pseudophasmatinae.

The distribution of the subfamily is probably limited to the islands of the East Indies and the Malay Peninsula. All four species occur in Borneo; reliable records from outside Borneo refer to only one species, *Kalocorinnis pulchella* (de Haan).

SYSTEMATIC PART

Kalocorinnis Günther

Kalocorinnis Günther, 1944: 77. – Type species *Kalocorinnis calopteryx* Günther 1944 by original designation [= *K. pulchella* (de Haan, 1842)].

Kalocorinnis pulchella (de Haan) **comb.n.**

(figs. 1-4)

Phasma (*Necrosia*) *pulchellum* de Haan, 1842: 120, pl. XV fig. 5. – Holotype ♂, Sumatra, Batang Singalang (RMNH) [examined].

Necrosia pulchella (de Haan). – Westwood 1859: 152; Kirby 1904: 377.

Tagesoidea pulchella (de Haan). – Redtenbacher 1908: 565.

Kalocorinnis calopteryx Günther, 1944: 78, fig. 5. – Holotype: ♀, Nordborneo (RMNH) [examined], Paratypes: ♀, Central-Borneo (SMTD); ♂, Peninsular Malaysia, Selangor, Bukit Kutu, 1100m, 13-iii-1931, H.M. Pendlebury (RMNH) [examined]. **Syn. n.**

Material examined. – Holotypes: *Phasma* (*Necrosia*) *pulchellum*, ♂; *Kalocorinnis calopteryx*, ♀. Paratype: *Kalocorinnis calopteryx*, ♂. – Others: Midden O-Borneo, 14.viii.1925, H. C. Siebers, 1 ♀ (RMNH); E. Borneo, 125m Tabang, Bengen River, 28.x.1956, A.M.R. Wegner, 3 ♂ (RMNH); Sarawak, J.E.A. Lewis, 1 ♂ (BMNH, 1910-116); Sarawak, Wallace, 1 ♂ (OXUM); Sabah, Danum Valley, 220m, light trap sample, roadside, secondary forest, 10.ix.1987, A.H. Kirks-Spriggs, 1 ♀ (NMWC, NMW.Z.1987.094).

Examination of the holotype of *pulchella* showed that it belongs in the subfamily Korinninae; the original description makes no mention of the characteristic which is used to distinguish the two suborders. Direct comparison of de Haan's male holotype, and

Günther's male paratype leave no doubt that they are the same species.

Rather unusually for phasmids, the wings of this species are brightly coloured and have a distinctive pattern. In view of the fact that the species had already been described and well illustrated (de Haan 1842), and had been recorded from Borneo (Westwood 1859: 152), Günther's description of *Kalocorinnis calopteryx* as a new species from Borneo might appear strange. However some research into the background suggests a rational explanation of this.

The most recent comprehensive work on Phasmida is the three part monograph by Brunner von Wattenwyl (1907) and Redtenbacher (1906, 1908), this is still used as the basis for identification of phasmids by most workers. Redtenbacher (1908) placed *pulchella* in his 'Tribus Necrosiini' (now the subfamily Necrosiinae). This was presumably based only on de Haan's description and illustration; the species is not represented in Redtenbacher's collection. De Haan's description is quite brief and makes no mention of the feature which distinguishes the two suborders of Phasmida: the sunken triangular area on the middle and hind tibiae. It appears that Günther had not seen de Haan's type specimen; Leiden Museum records show no evidence of a visit by Günther. The illustrations in de Haan's publication (1842) are very accurately drawn but are hand coloured; examination of two copies (RMNH and Oxford University library) has shown that the pattern on the wings varies (although less than can occur in the insects themselves). Westwood (1859: 152) correctly identified Wallace's specimen although it differs considerably from de Haan's specimen (figs. 1, 4). Günther probably did not consider the possibility that Redtenbacher had placed the species in the wrong suborder, the species is so distinctive that he would almost certainly have recognised it despite variations in de Haan's illustrations.

The type specimens have suffered damage since they were originally described. The holotype of *pulchella* has only two legs remaining, the right fore leg and left mid leg; the tarsi of both these legs are missing. Günther illustrated the *calopteryx* holotype (1944: 75, fig. 5) at which time it had one antenna missing, it has since lost both front and both middle legs; the male paratype lacks both front legs, the left mid leg, both antennae, and the end of the abdomen.

This species shows variation in both colour and pattern of the wing patches. There is considerable variation in the shape of the patches of the males (figs. 1-4), this is particularly noticeable in Wallace's specimen which has greatly reduced patches. The wing patches of all three females which have been examined, and the two male types, are cream coloured.

One of the three Tabang males has pale blue-green patches, the other two have white patches with a blue-green tinge to the veins. Wallace's male also has blue-green patches. The BMNH specimen has yellow patches. Table 1 gives measurements of the female collected by Siebers and one of the males collected by Wegner, part of the abdomen of the male is missing.

This species appears to be quite widespread, having been recorded from Borneo, peninsular Malaysia and Sumatra. Within Borneo it has been recorded from Sabah (Günther's male paratype and NMWC specimen), Sarawak (Westwood, 1859: 152, and Lewis) and Kalimantan (Wegner, Siebers, and Günther's female paratype).

***Kalocorinnis wegneri* sp.n.**
(fig. 5)

Type material. – Holotype ♀: East Borneo, 125m Tabang, Bengen River, 3.ix.1956, A.M.R. Wegner (RMNH). – Paratype ♀: Sabah, Sepilok, 23-ii-1983, Shinji Nagai (C.L. Chan).

The holotype is in poor condition; all the internal parts of the head and thorax have been eaten, as have all thoracic sternites; the one remaining antenna is broken; the left hind and mid legs are missing and only one tarsus remains; the abdomen is shrunken and distorted. Despite the poor condition, the wings are very distinctive and this species is unlikely to be confused with any other.

The paratype is in better condition than the holotype, but lacks any front legs, antennae, left mid leg and right mid tarsus. It differs from the holotype by being slightly longer (57 mm), and by being more brightly coloured. It is likely that the colour of the holotype was originally similar to the paratype. The abdomen is much fatter, while some of this is due to dorso-ventral compression during preservation, it clearly shows that the abdomen of the holotype is badly shrunken.

Measurements of the holotype and paratype are given in table 1. Figure 5 is based on the holotype but has been modified to take some account of the damage and distortion of the specimen; the right wing has been omitted.

Head globular, longer than wide, smooth. Eyes prominent. Antennae filiform; light brown at the base, becoming darker (broken off).

Pronotum mid brown, lateral surfaces green in the paratype; smooth, with a deep transverse indentation about one third of the way from the front margin. Mesonotum granulose; narrow, with parallel sides at the anterior; widening and swelling suddenly one third of the way back; with two pairs of laterally pointing blunt spines near the front edge, and one

blunt spine on each side, slightly in front of the mid point of the swelling. Anterior third of holotype light brown, posterior portion mid to dark brown; paratype evenly mid brown dorsally and green on lateral surfaces. Metanotum and abdominal segments light brown; paratype with green lateral surfaces. It is possible that when live the whole of the paratype's abdomen may have been green.

Abdominal segments of the holotype are shrunken and distorted, those of the paratype are flattened, but the abdomen appears to narrow evenly along its length. Segments 1-7 becoming evenly shorter, 8th segment noticeably shorter than 7th; 9th and 10th much shorter and of equal length. The slender lamina supraanalis is as long as the 10th segment and tapers to a point. Operculum covered in bristles, with a deep notch at the apex.

Elytra almost circular; with an obvious hump near the outer margin; evenly covered in prominent fine veins.

Wings well rounded. Holotype with costal region chocolate brown, anal region of the wing tessellated dark brown and white, with an arc of large white patches about one two thirds of the way from the base of the wing, and small white triangular spots on the margin between the veins. Paratype with costal region of wings green in front of the main vein and mid brown behind; anal region dark brown with very few white tessellations; an arc of pale blue patches corresponds to the white patches of the holotype; the white triangles on the margin are present but some have a pale blue tint.

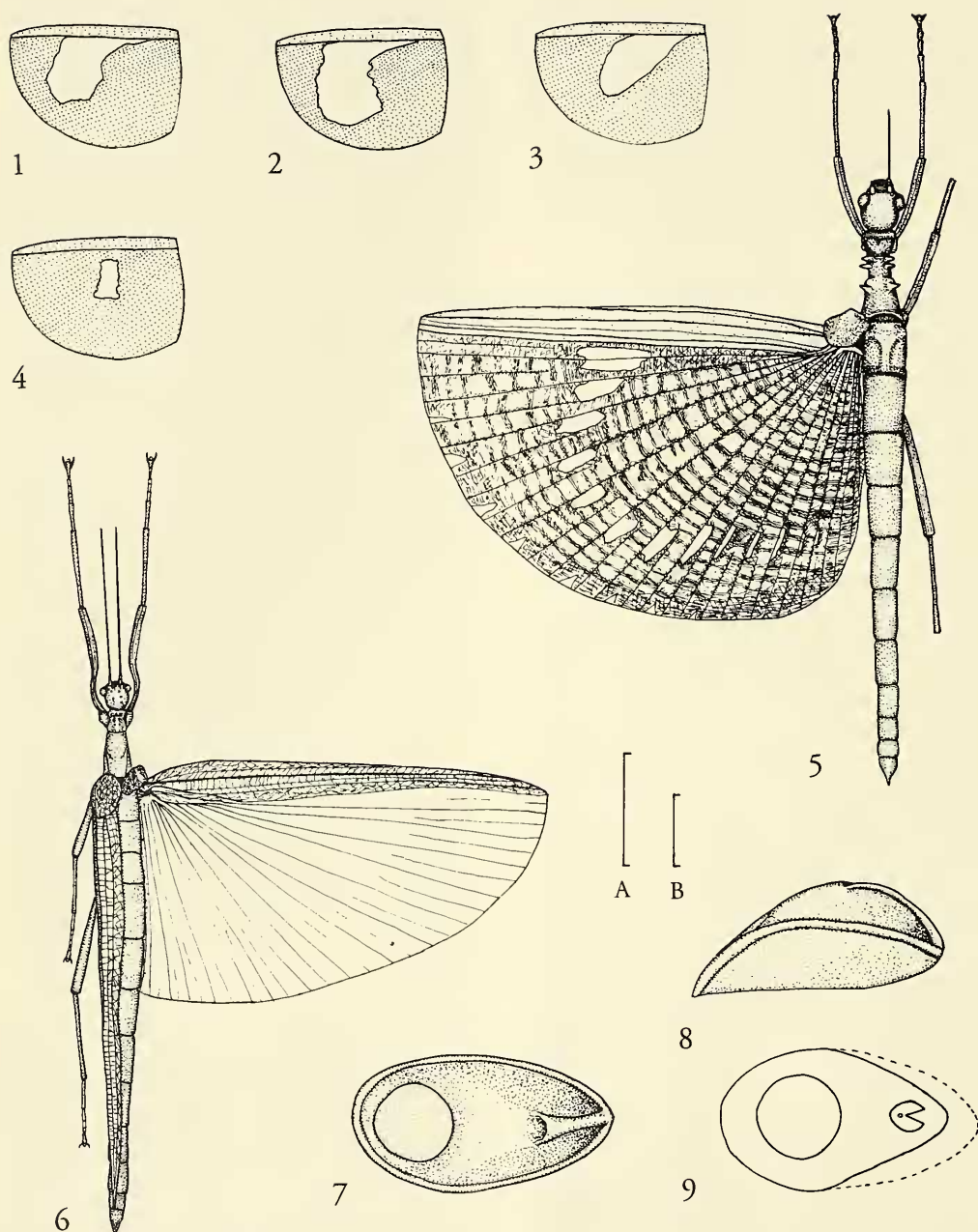
Femora all with four carinae; smooth, apart from fine bristles mainly on the carinae. The fore femora are straight and narrow only slightly at the base. Hind femora slightly enlarged and laterally compressed.

Tibiae with four indistinct carinae; only slightly widened at the apices. Fore and mid tarsi with five segments; first tarsomere one third of the total; fourth tarsomere very short. (Middle tarsi missing from both specimens).

Male: Unknown.

Egg. – Several eggs (figs. 7-9) were removed from the body of the paratype by rehydration and partial dissection of the abdomen. While some eggs appear to be fully developed, there may be some slight differences in surface detail between these and eggs which are laid. Some of the eggs have been slightly damaged during the original preservation or by their subsequent rehydration; this has caused some distortion of the ventral surface, as a consequence the true curvature of the ventral surface may differ slightly from that shown in the illustration (fig. 8).

Whole of capsule mid brown. Capsule twice as



Figs. 1-9. Korinninae. – 1-4. Wing patterns of male *Kalocorinnis pulchella* (de Haan): 1, De Haan's holotype; 2, Günther's paratype; 3, One of Wegner's specimens; 4, Wallace's specimen. – 5. *Kalocorinnis wegneri* sp. n., holotype ♀. – 6. *Korinnis errans* Günther, ♀. – 7-9. Egg of *Kalocorinnis wegneri* n.sp. (removed from paratype): 7, dorsal view; 8, lateral view; 9, internal view of dorsal surface. Scale line A (1 cm) for figs. 5 and 6, scale line B (1 mm) for figs. 7-9.

long as wide, tapering slightly at polar end, dorsal surface sloping steeply towards the ventral surface at the anterior end; ventral surface longitudinally almost flat, laterally sharply convex; dorsal surface strongly convex. A sharp ridge circles the egg, separating the dorsal and ventral surfaces; a similar ridge runs from the micropyle to the polar end. Operculum circular; at the anterior end of the dorsal surface. Micropylar plate indistinct externally; internally the plate is almost circular, open, with a triangular notch at the polar end (fig. 9). Typical measurements: length 3.8 mm, height 1.5 mm, width 2.0 mm.

Etymology. – *Wegneri*, after the collector A.M.R. Wegner.

Korinnis Günther

Korinnis Günther, 1932: 66. – Type species *K. potameis* Günther, 1932 by original designation.

Korinnis potameis Günther

Korinnis potameis Günther, 1932: 67, fig. 1. – Holotype ♀, Kalimantan, Noesa Djangkai on the lower reaches of the River Serawai, 19-xi-1924.

Korinnis potameis. – Günther 1943: 151.

Material examined. – Kalimantan, Mahakam, expedition of Dr Nieuwenhuis, 1894 [det. Günther, 1943: 151], 1 ♀ (RMNH); same data [det. Günther, but not mentioned in Günther 1943], ♀ nymph (RMNH); Kalimantan Tengah, Sungai Ratu Miri, Ratu Miri logging camp, to lights, 22-viii-1993, P.E. Bragg, 1 ♀ (P.E. Bragg, PEB-1999).

Table 1 gives measurements of the two adult specimens which have been examined. The specimen collected by the author was kept alive for four days but did not lay any eggs. Colour transparencies (Kodachrome 64 ASA film) were taken and used in conjunction with the preserved specimen for the following description of the coloration of the insect.

Head, pronotum, mesonotum and leading edge of elytra a glossy mid brown. Spines on the mesonotum with black tips. Head with a large almost round pea-green spot between the eyes. Sides and underneath of body, and whole of abdomen, blueish-green; final three abdominal segments with a chocolate brown longitudinal stripe. Costal and subcostal areas of wing blueish-green, radial and medial areas pea-green; radial vein distinctly orangy-brown with a narrow white line on the hind margin of the subcostal area. The anal region of the wing pale rose-pink. Elytra blueish-green on the leading edge, glossy mid-brown on the humped portion, pea-green on the outer trailing edge and bright yellow on the inner trailing edge. All femora, fore tibiae and fore tarsi glossy mid-brown, fore femora yellowish green at the base. Mid and hind tibiae very pale green, brown at apices. Mid and hind tarsi very pale green at the base becoming mid brown at the apices. Antennae very dark brown, almost black, with some pale bands towards the apices.

Remarks. – Maps of Kalimantan are of limited value for finding precise localities, they are often marked 'data incomplete' and not all rivers and villages are named. Attempts to locate Noesa Djangkai on available maps have been unsuccessful, however a village called Nanga Serawai has been located on the confluence of the rivers Melawei and Serawai; this suggests

Table 1. Measurements of specimens examined in detail

Length (mm)	<i>Kalocorinnis</i>		<i>Korinnis</i>		
	♂ <i>pulchella</i>	♀ <i>pulchella</i>	♂ <i>wegneri</i>	♀ <i>potameis</i>	♀ <i>errans</i>
Total	>28	38	53-57	58-59	48
Antennae	>26	>16	>6	25	>13
Head	2.5	3	4.5-5	4	3.5
Pronotum	1.5	2	2	2.5	1.5
Mesonotum	4	5	5.5-6	6.5-7	4.5
Metanotum & median segment	6.5	8.5	10-11	9-10	8
Elytra	1.5	2.5	4-4.5	4.5-5	4
Wing	21	27	40	40-41	35
Fore femora	6.5	7	9	10.5-11.5	9.5
Fore tibiae	5	4.5	7	7-9	7
Fore tarsi	5	4.5	6	6-7	6
Mid femora	5	5	7-7.5	7.5-8.5	7
Mid tibiae	4	3.5	5	5-6.5	5
Mid tarsi	4	3.5	-	4.5-5.5	4.5
Hind femora	8	8	10.5-11	11.5-13	11
Hind tibiae	6.5	6	9	8-10.5	8
Hind tarsi	5	5	7	5.5-7	6

that Noesa Djangkai is probably in the region around 0° 15'S, 112° 45'E. The specimens from Dr. Nieuwenhuis' expedition give 'Mahakam' as the locality; this is rather vague as the Mahakam, in eastern Kalimantan, is one of the longest rivers in Borneo. Neither the Ratu Miri logging camp, or the River Ratu Miri are marked on any available maps; the camp is estimated to be approximately 0° 30'S, 113° 35'E.

***Korinnis errans* Günther**
(fig. 6)

Korinnis errans Günther, 1938: 125. – Holotype ♀, Borneo? [Günther stated that the specimen was incorrectly labelled 'Sibsagar, Nordost Assam, S.E. Peal'] (NZSI).

Material examined. – [from Siebers' collection], 1 ♀ (RMNH); Sabah, Mt Kinabalu, Silau Silau trail, c. 1580m, 10.xi.1991, C. L. Chan (C. L. Chan) ♀; Sabah, Sepilok, 13.vi.1982, C. L. Chan & S. Nagai, 1 ♀ (C. L. Chan).

The female from RMNH which has been examined has no original data label other than the number 181 written in pencil. However there are two labels added by Klante in 1965; the first is a determination label, the second is a note that the specimen is 'without doubt from box 39 of the Siebers collection'. The RMNH collection contains a large number of phasmids collected in Borneo by Siebers in 1925. This supports Günther's suspicions about the locality of the holotype. This is confirmed by the two specimens in the collection of Mr C.L. Chan of Kota Kinabalu, Sabah.

The RMNH specimen agrees with Günther's description. Although the total length is only 3 mm shorter, there are three measurements notably different from those given by Günther: the length of the mesonotum is shorter (4.5 mm compared to 6.5 mm in Günther's description), the fore femora are shorter (9.5 mm compared to 11 mm), and the elytra are larger (4 mm compared to 3 mm); other size differences are minor. The length of the fore femora agree if it is assumed that Günther included the trochanter in his measurement. A complete set of measurements of Siebers' specimen is given in table 1, and the specimen is illustrated in figure 6.

The two specimens from the collection of C.L. Chan appear to differ considerably from each other. The Mt Kinabalu specimen, length 40 mm, is much smaller than the other specimens although the general proportions agree closely with the RMNH specimen. The Sepilok specimen, length 48 mm, has a more slender appearance due to the longer mesothorax

(5.5 mm), and longer legs; its proportions agree closely with those given by Günther.

In most respects these specimens agree closely with Günther's description; the differences may be due to intraspecific variation. There is a possibility that there are two species represented here but at present insufficient material is available to determine this with confidence.

It is worth noting that although the other members of the Korinninae have a few hairs on the radius of the wing, these specimens have numerous hairs all over the costal region; although those of the Sepilok specimen are less densely packed than the RMNH and Sepilok specimens.

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